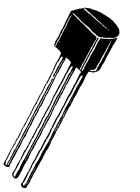
# 2N5224 (SILICON)

## NPN SILICON ANNULAR TRANSISTOR

. . . designed for general-purpose, low-level switching applications.

- Current Gain Specified at 10 mAdc and 100 mAdc
- Complete Switching Specification
- Low Collector-Base Capacitance –
  $C_{cb}$ = 4.0 pF (Max) @ $V_{CB}$ = 5.0 Vdc

## NPN SILICON SWITCHING TRANSISTOR



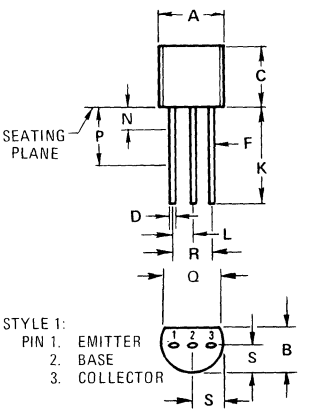
### *MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Emitter Voltage | $V_{CEO}$ | 12 | Vdc |
| Collector-Base Voltage | $V_{CB}$ | 25 | Vdc |
| Emitter-Base Voltage | $V_{EB}$ | 5.0 | Vdc |
| Collector Current – Continuous | $I_C$ | 200 | mAdc |
| Total Power Dissipation @ $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 350<br>2.8 | mW<br>mW/°C |
| Total Power Dissipation @ $T_C$ = 25°C<br>Derate above 25°C | $P_D$ | 1.0<br>8.0 | Watt<br>mW/°C |
| Operating and Storage Junction Temperature Range | $T_J$,$T_{stg}$ | -55 to +150 | °C |

### *THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$(1) | 357 | °C/W |
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 125 | °C/W |

*Indicates JEDEC Registered Data.
(1) $R_{\theta JA}$ is measured with the device soldered into a typical printed circuit board.




| DIM | MILLIMETERS MIN | MAX | INCHES MIN | MAX |
|---|---|---|---|---|
| A | 4.450 | 5.200 | 0.175 | 0.205 |
| B | 3.180 | 4.190 | 0.125 | 0.165 |
| C | 4.320 | 5.330 | 0.170 | 0.210 |
| D | 0.407 | 0.533 | 0.016 | 0.021 |
| F | 0.407 | 0.482 | 0.016 | 0.019 |
| K | 12.700 | – | 0.500 | – |
| L | 1.150 | 1.390 | 0.045 | 0.055 |
| N | – | 1.270 | – | 0.050 |
| P | 6.350 | – | 0.250 | – |
| Q | 3.430 | – | 0.135 | – |
| R | 2.410 | 2.670 | 0.095 | 0.105 |
| S | 2.030 | 2.670 | 0.080 | 0.105 |

CASE 29-02
TO-92

* **ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | |
| Collector-Emitter Breakdown Voltage (1) ($I_C$ = 10 mAdc, $I_B$ = 0) | $BV_{CEO}$ | 12 | - | Vdc |
| Collector-Base Breakdown Voltage ($I_C$ = 100 μAdc, $I_E$ = 0) | $BV_{CBO}$ | 25 | - | Vdc |
| Emitter-Base Breakdown Voltage ($I_E$ = 100 μAdc, $I_C$ = 0) | $BV_{EBO}$ | 5.0 | - | Vdc |
| Collector Cutoff Current ($V_{CB}$ = 15 Vdc, $I_E$ = 0) | $I_{CBO}$ | - | 500 | nAdc |
| Emitter Cutoff Current ($V_{BE}$ = 4.0 Vdc, $I_C$ = 0) | $I_{EBO}$ | - | 100 | μAdc |
| **ON CHARACTERISTICS** | | | | |
| DC Current Gain ($I_C$ = 10 mAdc, $V_{CE}$ = 1.0 Vdc) | $h_{FE}$ | 40 | 400 | - |
| ($I_C$ = 100 mAdc, $V_{CE}$ = 1.0 Vdc)(1) | | 15 | - | |
| Collector-Emitter Saturation Voltage ($I_C$ = 10 mAdc, $I_B$ = 3.0 mAdc) | $V_{CE(sat)}$ | - | 0.35 | Vdc |
| Base-Emitter Saturation Voltage ($I_C$ = 10 mAdc, $I_B$ = 3.0 mAdc) | $V_{BE(sat)}$ | - | 0.9 | Vdc |
| **DYNAMIC CHARACTERISTICS** | | | | |
| Current-Gain–Bandwidth Product ($I_C$ = 10 mAdc, $V_{CE}$ = 10 Vdc, f = 100 MHz) | $f_T$ | 250 | - | MHz |
| Collector-Base Capacitance ($V_{CB}$ = 5.0 Vdc, $I_E$ = 0, f = 1.0 MHz) | $C_{cb}$ | - | 4.0 | pF |
| **SWITCHING CHARACTERISTICS** | | | | |
| Delay Time; Rise Time ($V_{CC}$ = 3.0 Vdc, $V_{BE(off)}$ = 1.5 Vdc, $I_C$ = 10 mAdc, $I_{B1}$ = 3.0 mAdc) | $t_d$ | - | 25 | ns |
| | $t_r$ | - | 20 | ns |
| Storage Time; Fall Time ($V_{CC}$ = 3.0 Vdc, $I_C$ = 10 mA, $I_{B1}$ = $I_{B2}$ = 3.0 mAdc) | $t_s$ | - | 35 | ns |
| | $t_f$ | - | 25 | ns |

(1)Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2.0%.

* Indicates JEDEC Registered Data.

## FIGURE 1 – SWITCHING TIME TEST CIRCUIT